Image credit: NASA

National Aeronautics and Space Administration

Materials and Coatings

Highly Thermal Conductive Polymeric Composites

Carbon-based fillers for highly thermal conductive nanocomposite materials

NASA Langley Research Center has developed a method to create highly thermal conductive polymeric composites. Such materials can prove highly valuable in applications that require efficient, light-weight, and flexible thermal management solutions, such as liquid cooled ventilation garments worn by astronauts.

BENEFITS

- Relatively simple and inexpensive processing
- Can be incorporated with a wide variety of matrix materials to produce nanocomposites

APPLICATIONS

- Thermally conductive clothing and components
- Liquid cooled ventilation garments

technology solution

THE TECHNOLOGY

There has been much interest in developing polymeric nanocomposites with ultrahigh thermal conductivities, such as with exfoliated graphite or with carbon nanotubes. These materials exhibit thermal conductivity of 3,000 W/mK measured experimentally and up to 6,600 W/mK predicted from theoretical calculations. However, when added to polymers, the expected thermal conductivity enhancement is not realized due to poor interfacial thermal transfer.

This technology is a method of forming carbon-based fillers to be incorporated into highly thermal conductive nanocomposite materials. Formation methods include treatment of an expanded graphite with an alcohol/water mixture followed by further exfoliation of the graphite to form extremely thin carbon nanosheets that are on the order of between about 2 and about 10 nanometers in thickness. The carbon nanosheets can be functionalized and incorporated as fillers in polymer nanocomposites with extremely high thermal conductivities.

Highly conductive polymer nanocomposite tubing for use in liquid cooled ventilation garment. Image credit: NASA

Astronaut cooling garment. Image credit: NASA

PUBLICATIONS

Patent No: 9,067,794

Patent Pending

More Information

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NP-2015-08-2019-HQ

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LAR-17558-1, LAR-17558-2